Development of a Sierra Nevada Index of Biotic Integrity

Joseph L Furnish

Public Comments

No public comments were received for this proposal.

Initial Selection Panel Review

Proposal Title

#0281: Development of a Sierra Nevada Index of Biotic Integrity

Funding:

Do not fund

Initial Selection Panel (Primary) Review

Topic Areas

- Assessment And Monitoring

Please describe the relevance and strategic importance of this proposal in the context of this PSP. How does the proposal address the topic areas identified above? What are the broader CALFED Goals this proposal may meet that are not accounted for in these specific topic areas?

A very strong proposal from the point of view of resource management, planning, and monitoring. Supports CALFED goals in watershed management. The upper watersheds while important, may not be the highest priority for CALFED, and support for this work from CALFED (as opposed to EPA, USFS, RWQCB, CDFG) is harder to demonstrate. Reviewers note that this not cutting-edge science, but that is not its intent.

The budgets of proposals submitted in response to this PSP are larger, on average, than those submitted to CALFED in previous years. The Science Program is committed to getting as much science per dollar as is reasonably possible. With this commitment in mind, can the proposed budget be streamlined? If so, please recommend and clearly justify a new budget total in the space provided.

Evaluation Summary And Rating.

Provide a brief explanation of your summary rating and any additional comments you feel are pertinent.

It is difficult to recommend "Do not fund" without comparison to other proposals that will be reviewed in the meeting; especially in the area of watershed management. I would reserve the option to move to "Fund" upon discussion. "Fund with modification" does not seem appropriate, as the budget appears right for the proposed work. It is more a case of relevance to the mission than modifying the budget.

Selection Panel (Discussion) Review

fund this amount: $**0**
note:
do not fund

The Panel supported the objectives of this proposal. The project has a high likelihood of success and will produce a baseline for evaluating conditions in the higher−elevation portions of the San Francisco Estuary's watershed. The project team is well−qualified and has already demonstrated the feasibility of its approach. However, this project's relevance to restoration and management issues within the CALFED solution area was questioned. This study focuses largely on high−elevation areas that are not targets of much CALFED restoration and management activity. The Panel hopes that proponents will be successful in securing funding for this project from another funding source, but does not feel that funding the project from this solicitation's pool of money was strategically appropriate.

Panel Ranking: Do not fund

Technical Synthesis Panel Review

Proposal Title

#0281: Development of a Sierra Nevada Index of Biotic Integrity

Final Panel Rating
above average

Technical Synthesis Panel (Primary) Review

TSP Primary Reviewer's Evaluation Summary And Rating:

This project is very straightforward, with a good prototype study in southern California coauthored by one of the PIs. The PIs have much experience in these systems, prospects for success are quite certain, and the budget is quite reasonable by CALFED standards ($298 K). The experimental design and methods are very clear, and the PIs are very experienced and capable at this sort of work. They appear to be using the same techniques with many of the same people who successfully developed an IBI for streams in southern California. The project will result in a valuable database and criteria for standardized data collection in the future by several agencies. There appears to have been careful consideration and analysis determining that existing archived data can be incorporated in to the analysis. They currently have data from 146 sites and will add 150 more sites, and about half the sites needed for development of the metric have already been sampled. Although establishment of the database is very desirable, this is not investigative research per se, and it is unlikely that much new understanding or novel insights of general value will result. The PIs have rather low productivity in the primary literature, and one reviewer urges them to publish on their methods because of low emphasis in the past on peer−review of this type of work. This aspect is critically important and must be a part of products from this

research.

Additional Comments:

The fact that the PI’s salary will be paid by the USFS makes the proposal very cost−effective.

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Technical Synthesis Panel (Discussion) Review

TSP Observations, Findings And Recommendations:

Development of a Sierra Nevada Index of Biotic Integrity

Developing an index of biotic integrity (IBI) would be an important contribution to monitoring tools for the state, but it is not scientific research that would add substantial new thinking or concepts to our understanding of stream systems.

The researchers have a good prototype for doing the proposed study, and the likelihood of success is great. This is a carefully and well−conceived study to develop a monitoring tool, but it does not advance scientific understanding.

The apparently low probability that this project would result in a peer reviewed article of scientific importance was identified as a weakness. The PIs do not have a strong track record of peer−reviewed publications, but they have good taxonomic expertise and expertise in developing metrics. The budget was considered cost−effective, in particular because the salary of one of the main staff would be paid by the US Forest Service. Rating: above average

Technical Review #1

proposal title: Development of a Sierra Nevada Index of Biotic Integrity

Review Form

Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

Comments	**The goal of this proposal is to combine data from different macro-invertebrate sampling programs operating in Sierra Nevada waterways into a single metric of biotic integrity for each of ca. 300 sampling localities. Different methods have been used to measure benthic macroinvertbrate abundnace and diversity in ca. 150 sampling localities in freshwater sites along the west side of the Sierra Nevada. Recent studies, cited by the applicants, have compared the different sampling methodlogies and found that a) they are very similar and b) the differences between them are predictable (and thus correctable). The applicants plan to add ca. 150 more sampling sites to this pre-existing database. The end result will be a large dataset capable of establishing reference parameters for indices of biotic integrity created by measuring macroinvertebrate diversity.** **The applicants hope that this baseline of biotic integrity measures (as inferred from macroinvertebrate diversity and abundance) can be used to measure status and trends in water quality and ecosystem function in Sierra Nevada waterways. They cite the "Assesment and Monitoring" section of the Science Program's PSP in support of this effort. That section called for "research to evaluate how best to use benthic communities in streams to monitor conditions and evaluate whether benthic communities are key indicators of restoration progress in stream**

	environments." The use of of benthic macroinvertebrate communities as measures of water quality and quantity is a promising idea which has received much recent attention and research.
Rating	**excellent**

Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full−scale implementation project justified?

Comments	**The study is justified relative to existing knowledge. Recent studies demonstrating that data collected using different macroinvertebrate survey techniques can be combined in to a single metric, make the effort to combine and expand data collected in freshwaters of the Western Sierra Nevada (the source of almost all flow into the San Francisco Estuary) very valuable.** **I would feel more comfortable if the studies comparing different macroinvertebrate sampling protocols had been published in the peer−reviewed literature. I hope the applicants will work hard to publish some of their results as their validity can only be assessed by a thorough peer−review. The study's value will also increase if it reaches other researchers in this Estuary and others.** **The conceptual model for this study is simple: We can evaluate the success of freshwater restoration efforts only if we have base−line (historical) and reference (control) data to compare to that collected in "restored" waterways (the hypothesis could be stated in the negative as well to reflect**

	measures of degradation). Data on macroinvertebrate community structure may be one (though not the only) measure of biotic integrity that would serve as a valid metric for water quality/quantity in restored (or degraded) waterways. Integrating data from various different studies into a single metric will allow more effective and efficient comparisons adn will make use fo copious data collected previosuly.
Rating	**excellent**

Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

Comments	**The approach appears to be well-designed and feasible, although it would be nice if more of the studies upon which this one are based were published in the peer-reviewed literature.** **In each stream that has previously been measured, there is only ONE macroinvertebrate community. This study seeks to integrate different measures of macroinvertebrate community structure into ONE MEASURE of the macroinvertebrate community. This single metric will allow increased standardization and understanding of the spatial and temporal pattern of variance in measures of macroinvertebrate community structure.** **I am concerned with the applicants' decision to divide stream into level-of-development categories based on**

"degree of naturalness". The authors state that they will use "objective" measures to make this categorization; but, their limited description of these measures (Page 8, 1st paragraph and table 1) makes them seem quite subjective. What is (are) the variable(s) to be measured? What parameters determine "naturalness" and what's the justification for that parameterization? I'd be more inclined to measure these variables and then let the macroinvertebrate community indices (residuals from relationships with known clines) and water quality data tell me what levels of these variables produced "impacted" communities and water quality. Aren't the macroinverebrate communities supposed to reflect stream condition? Isn't that the point of measuring them in the first place? The results presented in Figure 4 could be expanded on in the text to demonstrate that these response "watershed condition" variables constrain the biotic integrity indices.

Also, I am concerned by the authors' reliance on linear statistics throughout the proposal. Use of linear statistics assumes that insect communities show a gradual, monotonic response to changes in watershed conditions rather than, perhaps, a threshold response. Also, the figure in which they display the response of biotic integrity measures to watershed variables (on which they have plotted several straight lines) demonstrates that these variables actually form a "constraint space" ("wedge" or triangular distribution). It is not appropriate to analyze a constraint space using linear statistics –– and such an approach also

	ignores some major implications of the data. The point is, I think the authors, the project, and CBDA, may benefit enormously if a statistician familiar with analyses of non−linear data and "constraint spaces" were involved in the project team. Although I applaud the effort to integrate and consolidate data into a single, powerful, valuable source, I believe the applicants must move beyond the mere description of biotic integrity index data to actually assess its value in characterizing stream conditions. See "products" below.
Rating	**very good**

Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives and within the grasp of authors?

Comments	**The approach is entirely feasible. The methodologies for a) combining index scores of different methods for the same site and b) surveying sites that have not been surveyed before, are all worked out and approved by major federal environmental management agencies. The scale is appropriate and necessary.**
Rating	**excellent**

Monitoring

If applicable, is monitoring appropriately designed (pre−post comparisons; treatment−control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

Comments	**This study will form at least part of the background for many (any) future monitoring projects of stream restoration on the west side of the Sierra. Documenting the status and variability of**

	macroinvertebrate communities in the Sierra Nevada and the sensitivity of index measures to human development and restoration activities is essential to a scientific understanding of ecosystem function and restoration.
Rating	**excellent**

Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

Comments	**I believe the applicants can produce valuable products in addition to those that they have promised (i.e. an historical database of macrinvertebrate community data and indices for the Sierra Nevada with the ability to compare "developed" to "reference" sites). I think the applicants should be required to produce several analyses of these data that are worthy of publishing in the peer−reviewed management literature. I want to stress that the applicants' can produce very valuable results from these data.** **After determining how to integrate the data, the applicants should determine how environmental clines (elevation, latitude, stream order, groundwater/surface water source) affect benthic macroinvertebrate clines. Subsequent measures of stream integrity (degraded or non−degraded) should be measured as residuals from these (and potentially other) known environmental gradients. The gradient analyses itself will form the basis for some basic but powerful biogeographic analyses that may allow prediction of change within the Sierra Nevada ecoprovince due to human development, global warming, water diversion, etc.** **Also, the authors claim that these biotic integrity measures can be used to measure improvements or**

declines in stream quality but they offer no assesment of the spatial (within/across stream) or temporal variability of these indices. As a result, we cannot assess what magnitude of change in the "index of biotic integrity" is necessary to detect actual changes in stream condition. This analysis should be possible given the size of the database the applicants are proposing.

Finally, the authors show (in figure 5) a rather simplistic use of index scores to determine "impairment thresholds" for measuring stream restoration. First, nearly half of the "test" or "development" sites have biotic integrity scores above the "impairment" threshholds. Second, the "impairment threshholds" appear to have been "eyeballed" from the lowest biotic integrity score among "reference" or "undeveloped sites". The approach does not account for the natural variability detected in biotic integrity scores of the SAMPLE of test sites analyzed. Thus, there could very well be even lower biotic integrity scores for reference sites than those seen here. If biotic integrity scores are this variable (even within classes of disturbance), they will not be very useful for determining recovery of streams (where should the "target" biotic integrity score be for any given restoration site?). The applicants must try to eliminate the variability due to clines in forcing variables (elevation, latitude, stream order, etc) and then analyze the RESIDUAL variability in the index scores. Once this background, deterministic ecological variance is removed from the data, thea authors should determine whether the biotic integriy data can be used to classify stream sites as "disturbed" or "undisturbed". Such a classification analysis would address the stated "justification" for this study: "to evaluate how best to use benthic communities in streams to monitor conditions and evaluate whether benthic communities are key indicators of restoration progress in stream environments".

	Analyses such as those above are vital to understanding the value of these macroinvertebrate community indices. These products should be part of peer−reviewed journal articles. **The data from the previous studies should be warehoused in an easily retrievable electronic format. The integration of these different data sets should NOT result in any loss of original data. Also, the original and integrated data as well as meta−data should be made widely available to other researchers and managers.**
Rating	**very good**

Additional Comments

Comments

Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

Comments	**The project team is well−qualified to conduct this research. They publish in reputable journals and have done this kind of research for their respective agencies before. They have the resources of different agencies at their disposal−−this should make it easy for them to get access to the data they need. As above, I recommend consultation with a statistician trained in analyses of non−linear data sets, data with lots of 0's, and constraint space analyses, but this should be easily accomplished and the applicants indicate that they have some understanding of and appreciation for these analytical issues.**
Rating	**excellent**

Budget

Is the budget reasonable and adequate for the work proposed?

Comments	**The overall cost for the project seems extremely reasonable. The budget is well-documented.**
Rating	**excellent**

Overall

Provide a brief explanation of your summary rating.

Comments	**CalFED's Science program should fund this kind of project. Although it is not rigorous, "hypothesis-testing" science, the careful integration of data from different sampling programs and the exapansion of the sampling program to cover the spatial extent of the Sierra Nevada will provide an extraordinarily valuable, centralized database on the benthic macroinvertebrate fauna of the major drainages of the San Francisco Estuary. This database, and the biotic integrity indices produced from it, will be an invaluable resource for a) further scientific inquiry and b) monitoring of restoration/degradation dynamics in the San Francsico Estuary's watershed. The project appears vital to the success of some SBDA goals and benefits greatly from use of previously collected data. This is a great opportunity.**
Rating	**excellent**

Technical Review #2

proposal title: Development of a Sierra Nevada Index of Biotic Integrity

Review Form

Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

Comments	**This project has direct application to the monitoring and assessment of California streams. It is an important step forward for California to join other states in developing viable biological indicators for their water quality program.**
Rating	**excellent**

Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full−scale implementation project justified?

Comments	**The conceptual model is based on proven approaches used throughout the US. The existing data for this project are of high quality and analyzing the broad regional distribution of streams as an aggregate is well grounded in science.**
Rating	**excellent**

Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

Comments	**This project brings together data from 3 different projects to maximize results and gain cost efficiency. The resulting model will be an important basis for Water Quality managers to make informed decisions regarding the aquatic resource.**
Rating	**excellent**

Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives and within the grasp of authors?

Comments	**The investigators are very knowledgeable with the concept, ecological principles, and appropriate bioassessment strategies. i believe the likelihood of success is very high.**
Rating	**excellent**

Monitoring

If applicable, is monitoring appropriately designed (pre−post comparisons; treatment−control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

Comments	**The monitoring component is well designed and consistent with approaches used in other water quality programs. Implementation of the results of this project will provide a method for the WQ agency to monitor stream health in a cost−effective way.**
Rating	**excellent**

Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

Comments	Yes to all of the above. The potential exists for a variety of documented reporting formats from protocols for collection to technical reports and peer-reviewed manuscripts.
Rating	very good

Additional Comments

Comments

Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

Comments	Very igh qualifications of the project team for this work.
Rating	excellent

Budget

Is the budget reasonable and adequate for the work proposed?

Comments	The budget is realistic. Cost efficiencies are gained by the 3 agencies pooling their data and expertise.
Rating	excellent

Overall

Provide a brief explanation of your summary rating.

Comments	This is the highest evaluation I have given for a CALFED proposal. I believe the purpose and objectives are well laid out, the approach and strategy well designed and articulated, the collaborative team very experienced and capable, and the budget realistic and

	benefitting from a large legacy database that will maximize effort.
Rating	**excellent**

Technical Review #3

proposal title: Development of a Sierra Nevada Index of Biotic Integrity

Review Form

Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

Comments	**The goals and objectives are very clearly stated and consisten with the technical work proposed. The idea is not novel but extremely timely and important because a region index of biotic integrity for streams in the Sierra Nevada portion of the Bay−Delta system does not exist.**
Rating	**excellent**

Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full−scale implementation project justified?

Comments	**Yes, the study is well justified. In fact, the study makes wise use of past data sets so that this work is part synthesis, part new data collection, and part new analysis all of which will led to a valuable tool for assessment of streams.**
Rating	**excellent**

Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to

generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

Comments	**The approach is well designed and appropriate for the objectives. I could quibble over some aspects but these authors are well versed in this type work and can make wise decisions as they go. Issues I am referring to include for example: 1)I really believe the site selection (for the 300 new sites) should not be too heavily weighted toward the foothills and southern subregions but should be spread carefully throughout the whole region. Despite references to past work (Herbst &Silldorff – note this is not published in a peer reviewed journal) suggesting that use of 'older' data thrown in with new data is 'ok', I am not convinced of this. It seems worthwhile to have adequate coverage of the entire region using the 300 new sites. 2)The data layers they are using to characterize sites all make sense but I wondered about the absence of data layers on water withdrawals, inter-basin transfers (if relevant), stormwater networks (if relevant). I have found these to be extremely important in explaining IBIs**
Rating	**very good**

Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives and within the grasp of authors?

Comments	**Yes, it is fully documente and technically feasible. Likelihood of success is extremely high and the project is quite appropriate given these authors' skills.**
Rating	**excellent**

Monitoring

If applicable, is monitoring appropriately designed (pre−post comparisons; treatment−control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

Comments	
Rating	**not applicable**

Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

Comments	**The product should be extremely valuable : a tool that can be broadly used to evaluate the health of streams in the SNP. It can also be used to prioritize sites for restoration.**
Rating	**excellent**

Additional Comments

Comments	**CBDA Staff Note: Ms. Palmer accidentally entered her review for this proposal (#281) into the form for Proposal #198. Jenna copied and pasted the comments and ratings from Proposal #198 into this proposal, then marked it complete.** **JO**

Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

Comments	**The track record seems very sound. They have published less in the peer reviewed literature than I would like to see. It is important that Ode's paper (which is**

	heavily cited in this proposal) is in a peer reviewed journa.
Rating	**good**

Budget

Is the budget reasonable and adequate for the work proposed?

Comments	**Before I looked at the budget page but after I had read the proposal, I thought...this would cost me about $250k to do. That's pretty close to their budget. I looked at their breakdown and it looks reasonable.**
Rating	**good**

Overall

Provide a brief explanation of your summary rating.

Comments	**Timely work that is well thought out and will be of use to managers. Will not break new scientific ground but is something that is needed for monitoring, prioritizing protection and restoration efforts in this region of the country.**
Rating	**excellent**